Water Resources Partnership

A Jointly Funded Agreement
between
Michigan State University
and the
Michigan Department of Environmental Quality

Focus:
Source Water Protection and
Holistic Water Resources Management

Principal Investigators:

Jon Bartholic, *Ph.D.*
Institute of Water Research

Shu-Guang Li, *Ph.D., P.E., F.GSA, F.ASCE*
Dept. of Civil and Environmental Engineering

David Lusch, *Ph.D., GISP*
Department of Geography
and
Institute of Water Research

Ruth Kline-Robach, *M.S.*
Institute of Water Research
and
Dept. of Community, Agriculture,
Recreation and Resource Studies

Water Resources Partnership

- **Frame of Reference**
  - New digital communication and analysis tools are needed to effectively address the complex water resource management issues of today.
  - When incorporated within a decision support process, such tools can enhance the effectiveness of local resource decisions.
  - Over the past decade, MSU and MDEQ have developed several tools that serve this purpose.

Water Resources Partnership

- **Frame of Reference**
  - MSU and MDEQ commit to an expanded **applied research and outreach partnership** to enhance and build upon these initial efforts in order to address statewide water resources management in an integrated and holistic manner.
  - Our goal is to **advance the art and science of integrated groundwater and surface water management**.

Water Resources Partnership

- **Financial commitment**
  - MDEQ has committed **$1 million** over four years.
  - MSU has invested **$500,000** over four years.

Water Resources Partnership

- **Two main activities funded by MDEQ**
  - Michigan Interactive Groundwater for Wellhead Protection (*MIGWWP*)
  - Technology and Outreach Enhancement of Michigan's Source Water Protection Activities

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Michigan Interactive Groundwater for Wellhead Protection

Dr. Shu-Guang Li
Professor of Water Resources and Environmental Engineering
Department of Civil and Environmental Engineering
Michigan State University.

Richard Mandle
Groundwater Modeling Specialist
DEQ.

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Michigan Interactive Groundwater for Wellhead Protection

Specific tasks

1. Develop improved methods for filtering well data
2. Develop an improved interface for hierarchical multiscale data analysis
3. Develop a sub-environment for real-time wellhead delineation
4. Pre-process high resolution, statewide SWL and K data
5. Delineate WHPAs statewide for all Community and Non-Community Public Water Supply Wells

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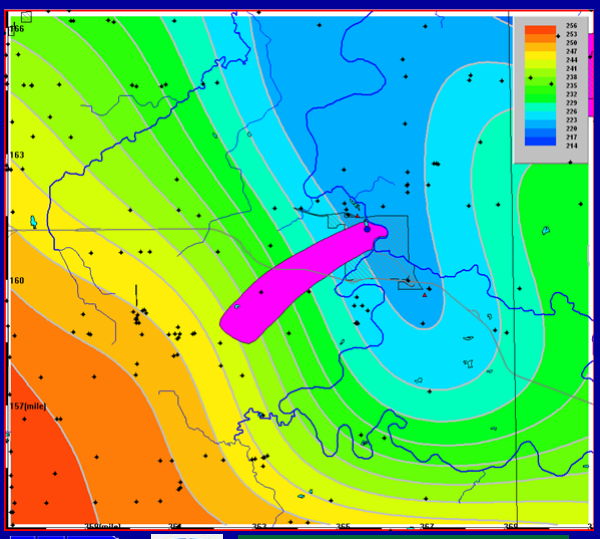
Michigan Interactive Groundwater for Wellhead Protection

Rick and Dr. Li will tell you much more about the MIGWWP part of this project in a few minutes.



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Technology and Outreach Enhancement of Michigan's Source Water Protection Activities

Two groups of specific tasks

1. Enhancing program efficiency and impact with technology
    - David Lusch, RS&GIS and IWR
2. Outreach and Program Facilitation
    - Ruth Kline-Robach, IWR

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Enhancing program efficiency and impact with technology

Four specific tasks

1. Continued technical assistance using the *MapImage Viewer* software. RS&GIS will continue to provide data updates and phone or e-mail assistance regarding the use of the MIV software.

2. RS&GIS will continue to maintain the intranet training and support materials for the *MapImage Viewer* software.

3. Develop and deploy a **web-based replacement** for the *MapImage Viewer* software.

4. (A) Continue hosting and maintaining the GWIM website
   (B) Continue to maintain the Wellogic *Water Well Download Program*.

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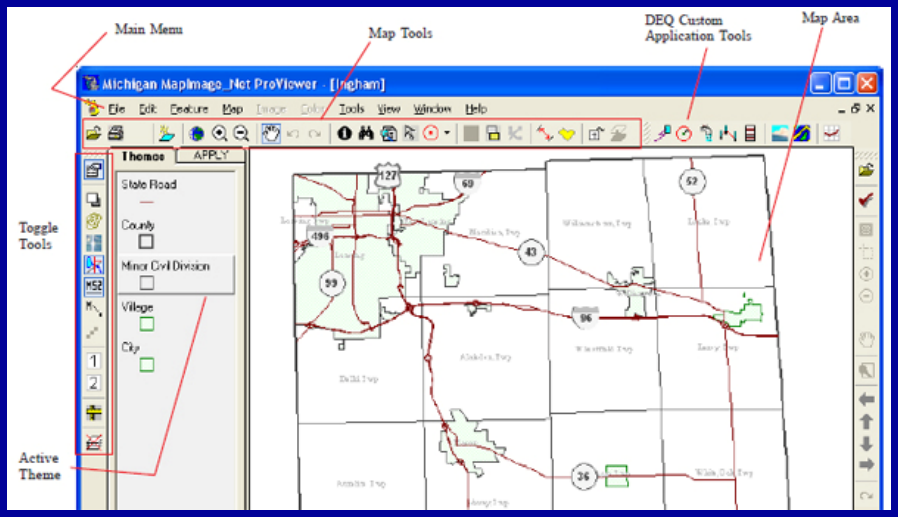
MapImage Viewer



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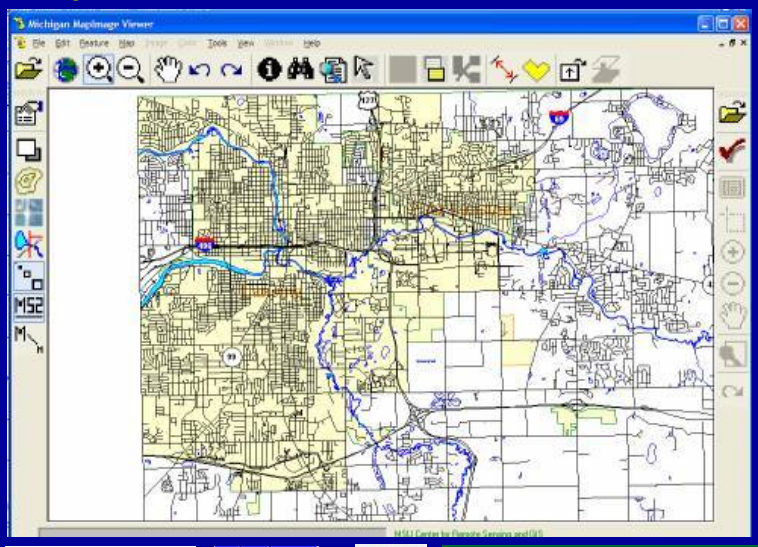

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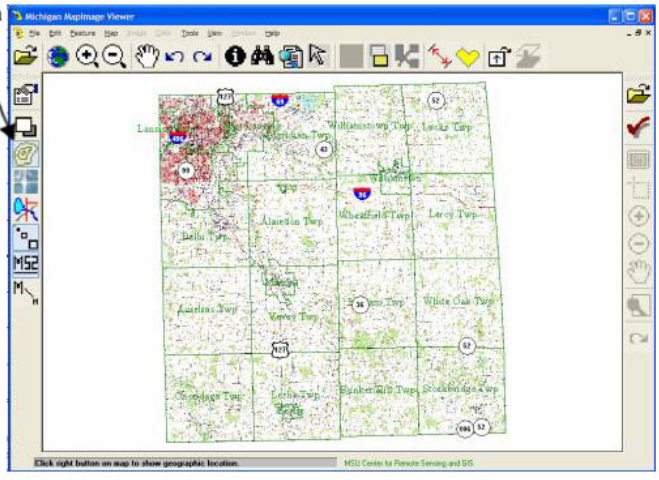
MapImage Viewer

Topoquad On/Off Button



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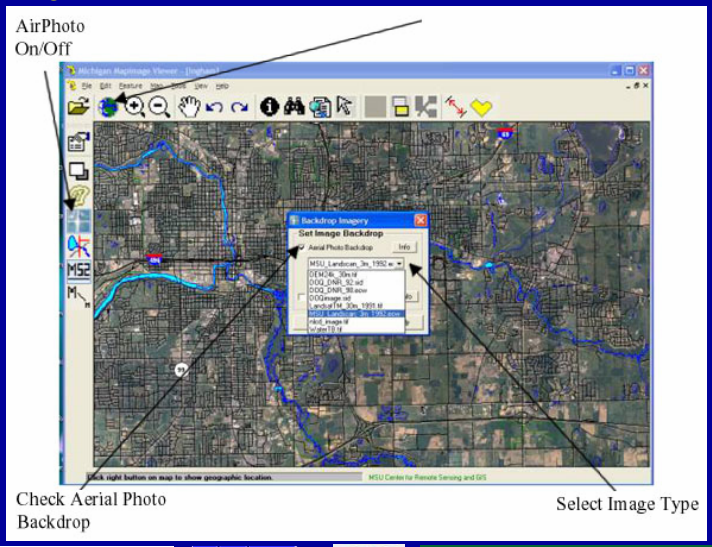

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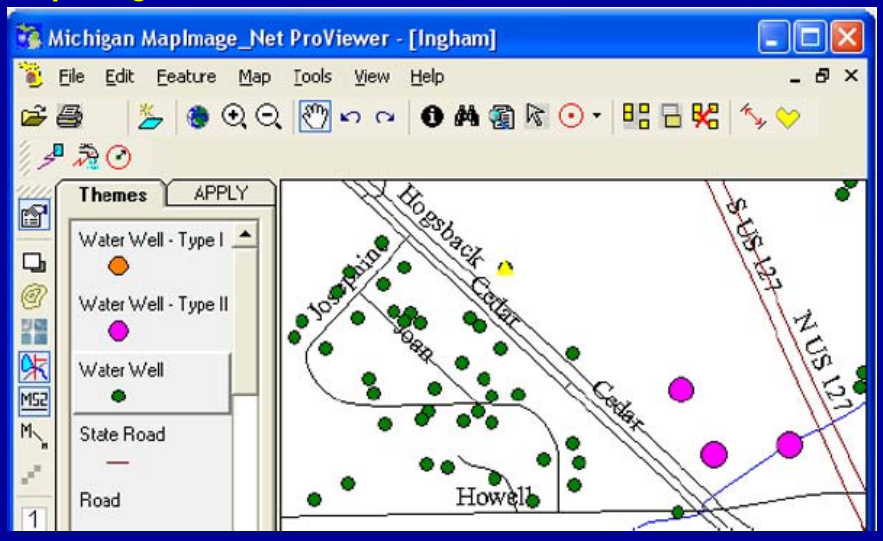

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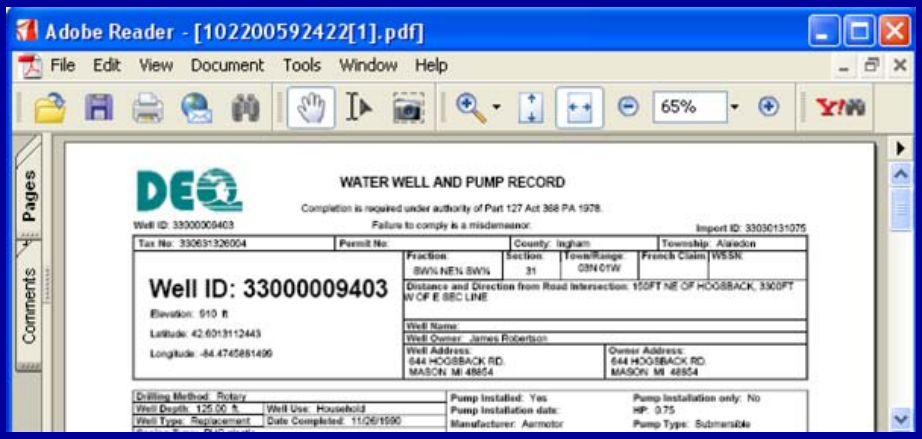

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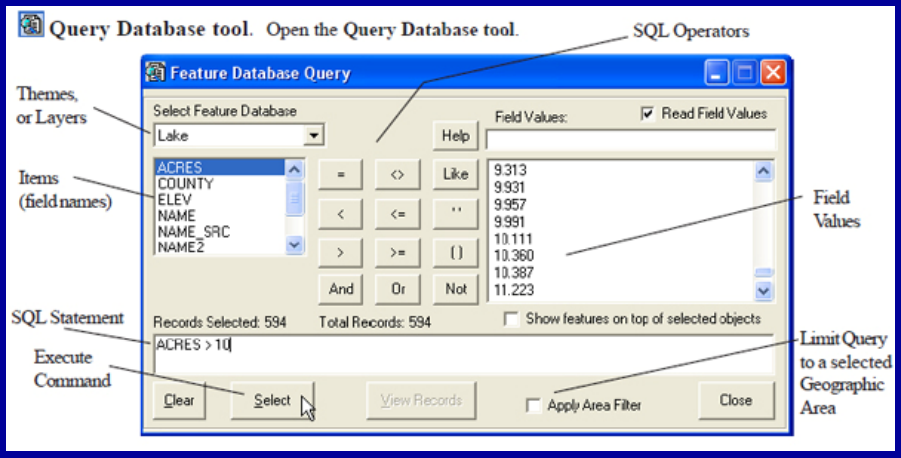


MapImage Viewer

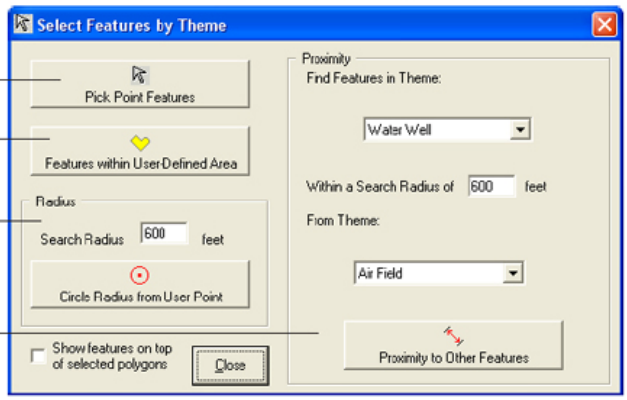
Select Feature by Theme Tool. This Map tool is used to select a feature or a set of features. This can be accomplished in four ways: by a direct selection, within an area, a radius, or in proximity to other features.

Point Selection tool (point theme must be active)

Area Selection tool (must have an active theme)

Radius Selection tool (must have an active theme). User specifies location and distance.

Spatial Selection tool. Selection based on proximity of other features.



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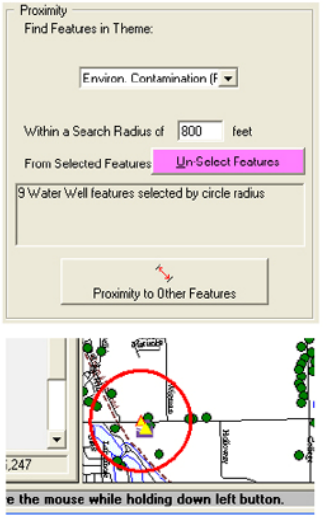
MapImage Viewer

Proximity Selection. This tool allows a user to explore the spatial relationship between two different themes.

- With a set of wells selected, choose the **Select feature** tool again. Notice on the Proximity half of the form, it displays how many wells you have selected (9 Water Well features are selected by circle radius in this example).
- Select Environ. Contamination from the drop-down list.
- Change the Search Raduis to 800 feet
- Press the **Proximity to Other Feature** button. In this example only one feature was found.
- It is possible that your Proximity selection brought back no SEC Environmental Sites. Try again by increasing the search radius.



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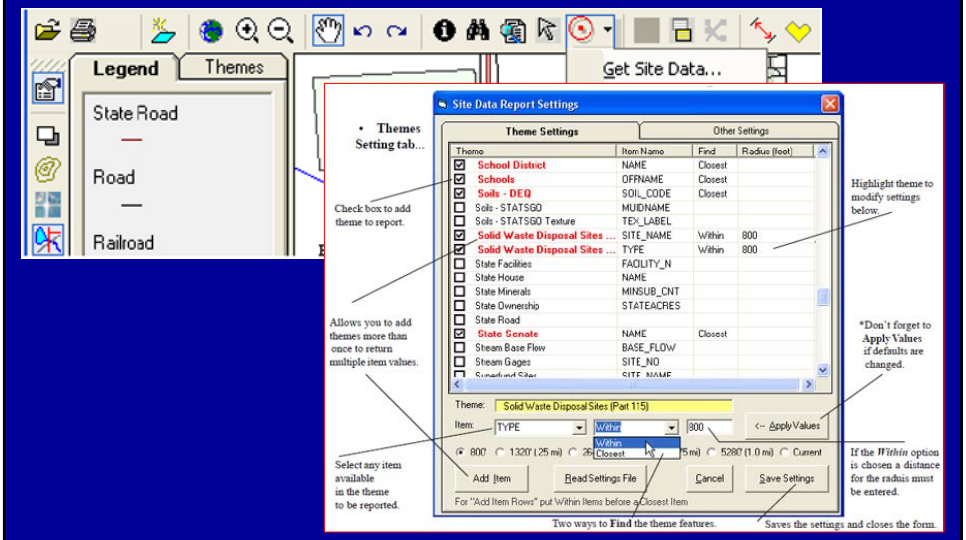

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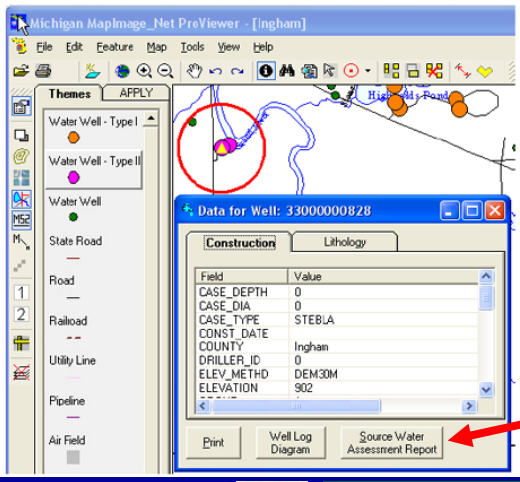
MapImage Viewer

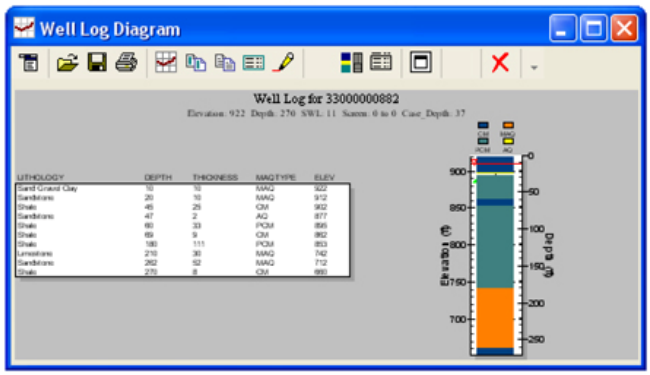
Viewing the Source Water Assessment Report with the MapImage Viewer

- Once you have added the Type II wells to the map, make it the active theme in the legend.
- Using the **Identify Feature (right click)** tool to open the construction amd lithology data for the Type II well.



MapImage Viewer

Click the **Well Log Diagram** button to create a graph showing the lithology formation column for that well.



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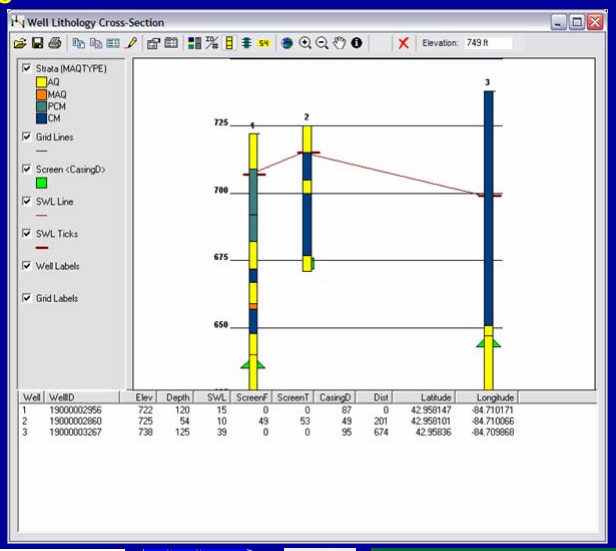

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Develop and deploy a web-based replacement for the *MapImage Viewer* software.

- Use *ArcGIS Server*, a new-generation of GIS software that provides an integrated, **server-based** GIS capability.
- DEQ end users will interact with a **browser-based** GIS. Each user session will access the most up-to-date data in the centralized geospatial database (housed at RS&GIS).

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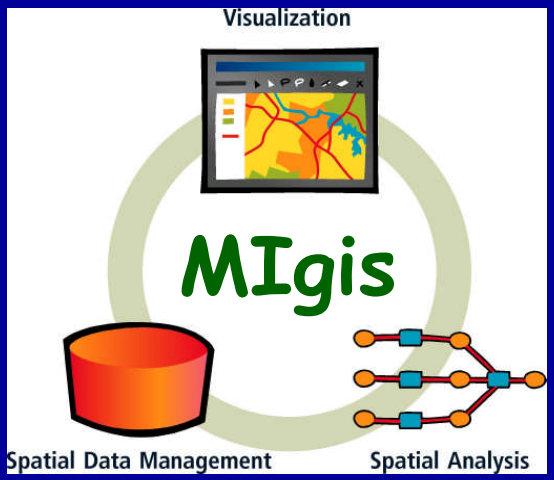

Develop and deploy a web-based replacement for the *MapImage Viewer* software.

- About 80% of the required "core functionality" of MIV can be created using the standard client - server model of *ArcGIS Server*.
- The majority (~75%) of DEQ end users will interact with a **browser-based** GIS that accesses an enterprise geospatial database.
- Some DEQ end users (~25% or less) may need to have a free, downloadable, client-side software application (*e.g. Arc Explorer*) installed on their workstation to accomplish advanced geoprocessing activities.

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• Three Main activities funded by MSU

1. **Exploring additional capabilities of IGW/MIGWWP** (Dr. Li)
   - Investigate new-well perturbation impacts on existing Wellogic data
   - Particle tracking for fate-and-transport (plume mapping) applications in environmental remediation
   - Surface water mapping using particle tracking

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• Three Main activities funded by MSU

2. Testing and expanding the Water Withdrawal Assessment Tool (Jon Bartholic, Dave Lusch, Jeremiah Asher)

- Predict potential conflict areas (targets for increased education/outreach)

- Track the impact of proposed groundwater withdrawals on stream base flows

- Factor in predicted climate change impacts on water availability in the water withdrawal model

- Expand the "ARI" concept to include wetlands

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• Three Main activities funded by MSU

3. Expanding outreach / engagement at the local level and enhancing outreach scholarship (Jon Bartholic, Ruth Kline-Robach, Lois Wolfson, Saichon Seedang)

- Evaluate the use and application of the various decision-support tools among key user groups, including agricultural and turfgrass irrigators, industry and public water supply systems

- Assess the impact of the tools related to public policy decision making